California Environmental Protection Agency

Air Resources Board

SECONDHAND SMOKE IN CARS FACT SHEET

I. SECONDHAND SMOKE IN CARS CAN BE TEN TIMES MORE CONCENTRATED THAN THE LEVEL CONSIDERED "UNHEALTHY" BY THE U.S. ENVIRONMENTAL PROTECTION AGENCY (U.S. EPA).

- People can begin to feel the effects of small airborne particle[1] pollution when daily outdoor concentrations measure above 15 micrograms per cubic meter ($\mu g/m^3$). When these levels are more than 40 $\mu g/m^3$, the U.S. EPA considers them "unhealthy." (Note 1)
- With a passenger window fully open in a car traveling at 20 miles per hour, continuous smoking will raise the average concentration of small secondhand smoke particles to twice the unhealthy level. (Note 2)
- Under the same conditions, peak concentrations of secondhand smoke particles can reach nearly ten times the unhealthy level. (Note 2)

II. PEAK SECONDHAND SMOKE LEVELS IN CARS CAN FAR EXCEED THE U.S. EPA "HAZARDOUS" LEVEL UNDER CERTAIN CONDITIONS.

- Daily concentrations of small air pollution particles greater than 250 $\mu g/m^3$ are considered "hazardous" under the U.S. EPA's Air Quality Index. (Note 1)
- Peak secondhand smoke concentrations measured in a car with the windows closed were found in the range of 3,000 to 4,000 $\mu g/m^3$. (Note 2)
- Peak measurements of secondhand smoke concentrations exceeded 1,000 $\mu g/m^3$ when measured in a car with the air conditioning system on and the windows closed. (Note 2)

III. EXPOSURE TO SECONDHAND SMOKE PARTICLES IN A CAR CAN EXCEED THE U.S. EPA'S 24-HOUR HEALTH-BASED STANDARD.

- The U.S. EPA has set a daily standard for small particle air pollution ($PM_{2.5}$) of 35 $\mu g/m^3$. (Note 1)
- This 24-hour average limit could be exceeded in approximately 20 minutes in a car with someone smoking and the windows closed. (Note 2)
- With a continuous smoker in a car with the windows open, this 24-hour average limit could be exceeded in approximately two hours. (Note 2)

IV. SECONDHAND SMOKE IN A CAR CAN EXCEED THE WORST DAILY PARTICLE AIR POLLUTION LEVELS IN THE STATE.

- In 2006, the highest daily average fine particle concentration in the state was 78 $\mu g/m^3$ ($PM_{2.5}$) in the Sacramento Valley. (Note 3)

- The mean $PM_{2.5}$ level measured in a parked car with the windows open, after one cigarette was smoked was measured at 82.4 $\mu g/m^3$. (Note 2)

V. CIGARETTE SMOKE PARTICLE EXPOSURE IN A CLOSED CAR IS COMPARABLE TO THE EXPOSURE A FIREFIGHTER MIGHT RECEIVE OVER FOUR TO EIGHT HOURS FIGHTING A CALIFORNIA WILDFIRE.

- The peak level of secondhand smoke particle concentration measured in a car traveling at 60 miles per hour (windows closed and the air conditioning on maximum) reached nearly 4,000 $\mu g/m^3$. (Note 2)
- Average firefighter exposure in California (during a wildfire) has been reported as 1,750 $\mu g/m^3$ of small particles (4-hour or 8-hour Time Weighted Average). (Note 4)
- Peak levels of small particle air pollution exposure that wildlife firefighters receive can be up to 5,000 $\mu g/m^3$ or more. (Note 5)

VI. ONE SMOKER EMITS FIFTY TIMES MORE FINE PARTICLES INTO A CAR THAN THOSE EMITTED PER-MILE BY A CAR'S TAILPIPE.

- On average, cars have been reported to emit 200 μg of fine particulate matter per-mile when warmed up; in contrast, a smoker can emit over 10,000 μg of fine particulate matter into the cabin of the car when they smoke a single cigarette. (Note 6).

VII. THE CONCENTRATION OF SECONDHAND SMOKE IN CARS CAN EXCEED THAT IN HOMES AND BARS BY TEN TO ONE HUNDRED TIMES.

- In bars, multiple smokers can raise small particle concentrations from 30 to 60 $\mu g /m^3$. (Note 7)
- A cigarette smoked in a bedroom can raise the level to 300 $\mu g /m^3$. (Note 8)
- In contrast, secondhand smoke particle concentrations inside cars, which have a much smaller volume of air to dilute the smoke, can be 400 to 3000 $\mu g /m^3$. (Note 2)

VIII. SECONDHAND SMOKE HAS WELL-DOCUMENTED ACUTE HEALTH EFFECTS.

- Secondhand smoke has been associated with long-term health effects including lung cancer and heart disease deaths; the serious short term, acute effects of exposure to secondhand smoke include: asthma attacks, respiratory infections, nasal and eye irritation, and lung irritation (cough and wheeze). (Note 9)

IX. SOME OF THE MORE THAN 4,000 CHEMICAL COMPOUNDS FOUND IN SECONDHAND SMOKE (also known as Environmental Tobacco Smoke or ETS) INCLUDE: BUTADIENE, ARSENIC, BENZENE, BENZO[A]PYRENE, CHROMIUM VI, AND FORMALDEHYDE.

- These compounds and others have been previously identified as carcinogens by the U.S. EPA, and as toxic air contaminants by the California Air Resources Board.

- ETS itself was identified by the California Air Resources Board as a toxic air contaminant in January 2006.

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[1] Small particles, or "respirable" particles, are those that measure 2.5 micrometers or less in diameter ($PM_{2.5}$). These particles are considered hazardous to human health because they can deposit deep inside the lung. Virtually all particles from a burning cigarette are measured in this range.

Links and References:

(Note 1) U.S. Environmental Protection Agency (USEPA) (2006) "Guideline for Reporting of Air Quality: The Air Quality Index (AQI)"(http://www.epa.gov/ttn/oarpg/t1/memoranda/rg701.pdf); U.S. EPA National Ambient Air Quality Standards (NAAQS): http://www.epa.gov/air/criteria.html

(Note 2) Ott, W. R., Klepeis, N. E., Switzer P. (2007) Air Change Rates of Motor Vehicles and In-Vehicle Pollutant Concentrations from Secondhand Smoke. *Journal of Exposure Science and Environmental Epidemiology*. doi:10.1038/sj.jes.7500601.
http://www.tobaccosmoke.org/OKS07

(Note 3) California Air Resources Board, Summary of Air Quality by Region: http://www.arb.ca.gov/adam/welcome.html ; Selected from the "worst sites in each of the 5 most populated regions: "Worst Sites" are the 2 monitoring sites for PM2.5 that experienced the highest number of days over the pollutant type's relevant standard during the years selected.

(Note 4) Materna, B. L., Jones J. R., Sutton P. M., Rothman N., Harrison R. J. (1992) Occupational Exposures in California Wildland Fire Fighting. *American Industrial Hygiene Association Journal.* 53(1): 69 - 76.

(Note 5) Personal communication to Dr. Neil Klepeis from Dr. Rufus Edwards (UC Irvine). Also see: Edwards, R. D., Johnson, M., Dunn, K. H., Naeher L. (2005) Application of Real-time Particle Sensors to Help Mitigate Exposures of Wildland Firefighters. *Archives of Environmental and Occupational Health.* 60(1): 40-43.

(Note 6) Maricq, M. M., Podsiadlik, D. H., Chase, R. E. (1999) "Examination of the Size-Resolved and Transient Nature of Motor Vehicle Particle Emissions." *Environmental Science and Technology*, 33 (110): 1618-1626. http://pubs.acs.org/cgi-bin/abstract.cgi/esthag/1999/33/i10/abs/es9808806.html . Nazaroff WW and Klepeis NE (2003) "Environmental Tobacco Smoke Particles," In: Indoor Environment: Airborne Particles and Settled Dust, edited by Lidia Morawska and Tunga Salthammer, Wiley-VCH, Weinheim, October 2003.

(Note 7) Klepeis NE (1999) "An Introduction to the Indirect Exposure Assessment Approach: Modeling Human Exposure Using Microenvironmental Measurements and the Recent National Human Activity Pattern Survey." *Environmental Health Perspectives Supplements*, 107(S2):365-374.)

(Note 8) Ott WR, Klepeis NE, Switzer P (2003) "Analytical Solutions to Compartmental Indoor Air Quality Models with Application to Environmental Tobacco Smoke Concentrations Measured in a House." *Journal of the Air and Waste Management Association*, 53:918-936.

(Note 9) U.S. Surgeon General's Report, 2006: "The Health Consequences of Involuntary Exposure to Tobacco Smoke: A Report of the Surgeon General" (http://www.surgeongeneral.gov/library/secondhandsmoke/) See also: Environmental Tobacco Smoke, a Toxic Air Contaminant" http://www.arb.ca.gov/toxics/ets/factsheetets.pdf